

## CHAPTER 5

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# FRAMING RESEARCH ON TECHNOLOGY AND STUDENT LEARNING IN ENGLISH EDUCATION DURING AN ERA OF CHANGING LITERACY PRACTICES

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*English education, more than any other discipline, because of its focus on language and representation, contributes vitally to the process by which our society defines, understands, maintains, and transforms itself.*

—Alsup, Emig, Pradl, Tremmel, and Yagelski (2006, p. 279)

The race continues. The world is “flattening” (Friedman, 2006), leading to a global market for competition, as well as for collaboration (Tapscott & Williams, 2006). Endless sets of test scores announce that U.S. students cannot read or write proficiently—although, in online spaces millions of them read and write, as well as produce and view multimedia content daily (see, for instance, research from the Pew Internet and American Life

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Project at <http://www.pewinternet.org> and MacArthur's Digital Learning initiative at <http://digitallearning.macfound.org>). At the same time, the computers in our nation's classrooms sit unused or underused (Cuban, 2001; Oppenheimer, 2003).

Thus, in this time of flux, English educators are positioned to explore what it means to be literate in a flat world, engage in teacher education and professional development that skillfully integrates technology and literacy practices, and define a research agenda for the field drawing on the rich traditions of experimental, ethnographic, and action research.

In this chapter, we consider these three interrelated tasks, all the while knowing that forces at work in the twenty-first century are unlike any that we as educators have dealt with before. We agree with Alsup et al. (2006), that our goal should be transformation; yet, the technology itself changes so fast that the implications for student learning and research in our field continue to shift. Consequently, we often feel as if we are running to stand still, just able to catch up with the state of technology and literacy for a short time as the literacies needed to function in the twenty-first century continue to evolve.

Yet, research in the field of English education must begin to play more of an integral role in the evolving landscape of information technology. Specifically, English educators must explore ways to integrate newer literacies into K-12 classrooms more effectively, as well as ways to better prepare beginning English language arts teachers to integrate newer technologies more effectively. As Swenson, Young, McGrail, Rozema, and Whitin (2006) emphasized,

English educators, individually and collectively, have the right and the responsibility to influence the development, modification, and adoption of the newer technologies they will integrate into their teaching and their students' learning, and they have the right to reject others. In order to adopt such a critical and proactive stance, however, teachers and teacher educators will need opportunities to develop nuanced and critical understandings of these technologies and the literacies with which they are associated. (p. 353)

Ultimately, English educators must examine their practice, theory, and research that suggest the benefits and affordances, as well as the limitations and liabilities, of integrating new and emerging technologies into the classroom. In this chapter, we contribute to this conversation by first outlining some of the affordances and constraints of technology in K-12 schools. We highlight three emerging trends in the intersection of literacy theory and technology, summarizing some of the current literature on technology and student learning in English. We then deconstruct the methodologies of two studies that attempt to determine the effects of technology on literacy learning in a digital age, both of which highlight

the complexities that researchers in the field of English education face. Finally, we discuss a number of questions that English educators should consider in future theoretical and empirical work.

### **AFFORDANCES AND CONSTRAINTS OF TECHNOLOGY IN THE ENGLISH LANGUAGE ARTS**

When desktop computers became available in schools during the 1980s, English language arts teachers were considered innovators of technology integration. Technology uses that were groundbreaking then, unfortunately, remain the most typical technology uses of today: word processing and recordkeeping (Becker, Ravitz, & Wong, 1999; Project Tomorrow—Netday, 2006a). Since the work in an English classroom assumes a broad approach to literacy instruction, this situation is problematic.

English educators are charged to prepare preservice and in-service teachers to consider not only ways in which we engage in meaning-making by using a variety of representational, interpretive, and communicative systems, but also to consider the synergistic relationships that exist between readers, writers, texts, contexts, and the situations in which texts, in their many forms, are written and read. (Swenson, Rozema, Young, McGrail, & Whitin, 2005, p. 211)

New and innovative technologies have created changes, challenges, and opportunities in education and suggest new ways to approach the way literacy is taught. As Leu, Mallette, Karchmer, and Kara-Soteriou (2005) explained, "Today, continuous, rapid change regularly redefines the nature of literacy as changing technologies regularly generate new literacies" (p. 2). Both schools and individual teachers struggle to keep up with these changes for many reasons, including a lack of professional development focusing on literacy practices with technology, a lack of access to strong infrastructure, and the institutional constraints of schools.

Yet, struggle as they may, the notion of a "literate" person continues to evolve and expand:

The content and pedagogy of literacy programs must reflect the literate practices of local to global communities and equip students for change. Educators cannot hope to teach students all they need to know, as this will change constantly. But teachers can equip their students with the knowledge, skills, strategies, and attitudes that will enable them to meet new situations and cope with them. (Anstey & Bull, 2006, p. 18)

New and emerging technologies present a challenge for English educators, but it is a challenge that must be faced, as technology holds much potential and promise for enhancing literacy education and, ultimately, literacy practices that could be embedded throughout students' everyday lives.

As Alsup et al. (2006) explained, "Living in a cyber world has transformed the very nature of literacy itself" (p. 284). More so than ever before, students access information and media today in many different ways, are in control of their media and search experiences, and are spending an increasing amount of time manipulating information technology and media (Ranie, 2007; Roberts, Foehr, & Rideout, 2005). However, most of this activity with technology and media takes place out of school rather than in school—a situation that must change if educators are to make the most of technology tools and address growing literacy connections. As teachers consider the implications engendered by this new approach to using technology in schools, literacy must remain at the center of the discussion.

### EMERGING TRENDS IN LITERACY THEORY

The New London Group (2000) and Lankshear and Knobel (2003) provided two closely related lines of literacy theory exploring the globalized and digitized texts that students consume and produce each day and clarify the current research related to reading and writing with computer technology. The evolving definitions of "literacy" in a time of rapidly changing technologies and social practices should ground the work of contemporary English educators.

The first theory, a "Pedagogy of Multiliteracies," emerged from the sociocultural and linguistically driven work of the New London Group (2000). The multiliteracies pedagogy engages learners in the study of both linguistic variation and semiotic modes (such as visual, aural, and gestural) to create texts. The New London Group suggested that learners become literate by engaging in four stages of literacy learning that examine "designs of meaning"; that is, the ways in which particular communities of people produce and consume texts. First, "situated practice" invites learners into discourse communities by introducing them to the language and norms of a particular group. Next, teachers engage in "overt instruction" to share the norms and expectations of that discourse as students learn how to make meaning through designing—that is, reading and writing—texts. Students then participate in "critical framing," where they learn to critique and reconstruct available designs of meaning.

Finally, they enter a stage of "transformed practice," taking what they have learned about design and transferring it to other cultural contexts.

The concept of being multiliterate across a range of various dialects, cultural spaces, and semiotic forms connects directly to English educators' concerns about a flattening world in which students will have to communicate across cultures (and sometimes across languages), largely in spaces mediated by technology. In other words, traditional definitions of reading and writing change as a contextual approach to teaching and learning literacy is adopted, a sensibility reflected in the two studies described later in the chapter.

The second theory, "New Literacies," was developed by Lankshear and Knobel (2003) to describe the ways in which newer technologies disrupt the typical notion of "literate." Extending the theory, Knobel and Lankshear (2006) discussed how new literacies are composed of two types of "stuff": "technical stuff" and "ethos stuff." The technical stuff has to do with the actual operation of digital equipment and is, perhaps, the easier of the two literacies to understand (we adults can learn the technical stuff; we all figured out how to program a VCR—eventually). The ethos stuff challenges us more. Knobel and Lankshear elaborated on the ethos, the approach humans take to understanding what being literate means, by describing two "mindsets" that accompany old and new ways of envisioning literacy:

We distinguish between two broad mindsets that people use to understand and orient themselves toward the world. One mindset approaches the contemporary world as being much the same now as it has been in the past, only a bit more "technologized"—it has digital technologies added to it, but is nonetheless to be understood and related to more or less as we have done for the past 200 to 300 years.... The other mindset sees the world as having changed very significantly from how it was, necessitating a different approach from the one used in the past.... It recognizes cyberspace as a fact of the new world, to be taken into account along with the physical world, but believes that cyberspace operates on the basis of different assumptions and values from physical space. (p. 80)

When these two mindsets conflict—as was the case in the *Encyclopedia Britannica* versus *Wikipedia* arguments of 2005 (Goodin, 2005)—they are most obvious. However, English educators need to be concerned when the conflicts are *most subtle*. The subtlety occurs, for instance, when teachers off-handedly dismiss *Wikipedia* as a source for valid information and instruct students to ignore it, despite the fact that it comes up in the top ten Google hits on hundreds of topics. Understanding new literacies and the shifts in thinking they require, especially the ethos stuff, becomes a critical component of inquiry in English education.

Given the historical context of inquiry in English education and the theories that have forced English educators to deeply reexamine their beliefs about what it means to be literate, we turn now to a brief discussion of broad themes emerging in research on the effects of technology on student learning in the English language arts. Before examining two particular studies, this chapter next explores how the key components of English—reading and writing—are being conceptualized and researched. We focused on reading and writing with the realization that listening, speaking, viewing, and visually representing could all be explored, too, especially given the context of multiliteracies. Yet, for the moment, most of the research focuses on these two aspects of English language arts. An examination of this trend helps reveal areas of inquiry that are insufficient or missing altogether and will need to be pursued in the future.

### THE NATURE OF THE RESEARCH IN READING AND WRITING

Although technology has produced dramatic effects in many other fields, it has yet to similarly transform education. Along with the field of social studies education and technology (see chapter 4), the field of English education and technology is still in its adolescence. “We are struggling with a discipline in metamorphosis” (Barrell, Hammett, Mayer, & Pradl, 2004, p. 2). Part of the slower progress in English education can be attributed to the evolving conception of how to define the field. McNabb (2005) described the situation in more dire terms: “When it comes to a theory about what works with regard to technology integration into English language arts, the research basis has a long way to go” (p. 113), because, in short, not enough studies have been conducted, and the existing research has not produced substantial evidence about the effects of prevalent technology practices on students’ literacy development.

Ultimately, little research has been conducted in the area of technology and literacy. Proving change with a technological intervention poses challenges that typical experimental designs do not necessarily allow for because of the complexity of the task. For instance, if the researcher chooses an experimental design, there may be ethical implications of providing technology resources for some research participants (especially if they are K–12 students) and not for others. This approach also assumes access for researchers to K–12 English language arts classrooms, teachers, and students—another challenge for researchers, especially when so much of the focus of these classrooms is preparation for standardized reading and writing tests.

According to Swenson et al. (2005), "Existing research on the impact of newer technologies on students' literacy tends to be anecdotal and descriptive rather than definitive and prescriptive" (p. 218). In many ways, this tendency toward anecdotal description honors the humanistic tradition from which English education has emerged. Although rigorous qualitative approaches to research are accepted in the field, they are not as popular nor, perhaps, considered as valid as more traditional quantitative approaches with experimental design methods in the current political era of No Child Left Behind reform efforts. This perception is one English educators must work to combat.

Part of the discipline's metamorphosis includes addressing the current educational climate's focus on experimental design and better defining English education research, in general (see DeBlase et al., 2007; Dipardo et al., 2006), including a call for additional studies in the area of technology and English education. In their review of research on reading and writing published between 1986 and 1996, Kamil, Intrator, and Kim (2000) found that less than 5% of the articles addressed issues associated with technology. Of this small percentage, the two primary areas included the following: (a) the effects on writing with computers, and (b) ways hyperlinked texts and multimedia change the reading process.

In a review of 2 decades of evaluation studies addressing writing, Kulik (2003) found that "students who use word processors for writing compositions demonstrate superior writing skills in later follow-up tests of writing skills" (p. vii). More recently, and based on a meta-analysis of existing studies, Graham and Perin (2006) could find evidence of only one technology—word processing—that was an effective approach to teaching writing. Yet, word processing is only a small part of writing for today's students. English educators also want to consider the changed context for reading and writing in digital, networked environments. Similarly, research on reading in digital environments has only recently become a focus of attention.

Limitations exist for the research on technology's effects in English education. First, research about technology and literacy has generally focused on traditional literacy practices grounded in print texts, and many of the technology practices mimic existing literacy methods—often drill-and-practice models—used in traditional reading instruction. Second, the limitations in both number of studies and methodologies employed is a concern. Given these concerns, broader considerations of how technology and literacy have been studied in the past, as well as broader considerations of how the research questions in the field should be framed and how they should be engaged in and answered, are needed.

### **SELECTED RESEARCH ON TECHNOLOGY AND STUDENT LEARNING IN THE ENGLISH LANGUAGE ARTS**

We have chosen two studies that seem to embody the methodological complexity of determining the effects of technology on students' learning in English language arts. Warschauer's (2006) study of one-to-one laptop programs in Maine and California across a variety of school settings is described in order to highlight his triangulation of data from a variety of sources using the lens of literacy, not just technology, to do so.

Coiro and Dobler's (2007) study of the comprehension strategies used by skilled sixth-grade students as they read online texts models a rigorous qualitative methodology. The researchers examined readers' practices within tasks that mirror classroom-bounded academic literacies, as opposed to new literacy tasks more regularly found in contexts outside of the classroom (Lenhart, Madden, & Hitlin, 2005; Lenhart, Rainie, & Lewis, 2001).

Together, these two studies represent what the field of English education can do to examine ways teacher preparation can impact student performance, all the while recognizing the methodological complexity surrounding any measurement of the impact on student learning as a result of using technology in literacy practices.

#### **Study 1: Laptops and Literacy**

New and multiple literacies complicate understandings of what it means to read and write in a digital age.

With the growing range of texts available to students today, literacy skills have expanded to reading images, codes, and sounds in addition to words. Greater emphasis must be placed on how various forms of technology, media, and modalities shape students' encounters with and creation of texts, as well as the meaning they are deriving from and/or creating with them. The various networks available to students today allow them to explore a variety of texts and meanings in almost infinite ways, depending on how they access, modify, generate, send, and archive print and multimedia texts. Computer technology, especially Web-based applications, create innovative possibilities to combine multiple literacies, modes, and technologies in compelling ways and reinvent notions of text, audience, purpose, context, performance, and genre that consider, but also extend and make dynamic, traditional print media. (Swenson et al., 2006, p. 223)

By extension, new and multiple literacies also complicate understandings of what it means to conduct research on the effects of technology on

students' abilities to read and write. Nowhere does the confluence of new literacies and technologies collide with traditional literacies and academic structures more than in classrooms with one-to-one laptop programs. Mark Warschauer and his team situated their work as literacy researchers in a one-to-one laptop program and demonstrated the methodological flexibility needed to document teacher and student literacy practices.

In his book, *Laptops and Literacy: Learning in the Wireless Classroom*, Warschauer (2006) analyzed what occurs "when one of the most disruptive technologies of communication in history is placed in the hands of every student in a classroom, grade, or school" (p. ix). In so doing, he and his team faced the methodological challenge of showing results directly correlated to laptop use and consistent across different school contexts. He aimed to overcome the shortcomings of previous studies, all of which failed to

- Carry out "extensive and systematic observations of laptop programs in a number of schools" (p. 33).
- Focus specifically "on culturally and linguistically diverse learners, including large numbers of English language learners" (p. 33).
- Use the "lens of literacy" to address how "'traditional' literacies such as reading and writing, with 'new' literacies such as information literacy and media design" offer more complex insights into computer use and classroom instruction (p. 34).

Thus, Warschauer and his team adopted a 2-year, multisite case study approach, looking at one-to-one initiatives in California and Maine, at programs ranging from third through twelfth grades, from rural to urban schools, from leasing to federal grant funding, and from diverse ethnic and socio-economic groups (p. 35). The team combined observations, interviews, surveys, and document reviews to provide a rich and nuanced picture of laptop implementation in classrooms and, in turn, literacy implications for teachers and students.

Through this work—and by grounding his approach to what counts as literacy with arguments from scholars such as Gee (2003, 2004), Ong (1982), Freire and Macdeo (1987), Fairclough (1992a, 1992b), and the New London Group (1996)—Warschauer (2006) concluded that teachers who use a combination of traditional and new literacies can elicit changes in students' literacy practices.

As a consequence of his methodological sophistication, Warschauer (2006) could make valid claims about the relationship between laptop programs and student use in home and school (more work being completed), the gap between the rich and the poor (offering an advantage to those without home computers), and implementation of future laptop

programs. In his book review of Warschauer's text, Marshall (2007) summarized the primary gains students made. First, with reading, students improved critical reading practices, although reading test scores did not improve for the laptop users as compared to other comparable students. In relation to writing, however, there were improvements; Warschauer's findings echoed the results of Graham and Perin (2006) in that word processing improved student writing based on standardized measures. Moreover, students were able to compose better texts because of the support tools available (spelling and grammar checkers), tools for feedback and revision, and the ability to format texts to look more professional. Warschauer's work pushed the boundaries of theory and practice, thus enacting the goal that Alsup et al. (2006) defined for English educators—to transform society. In considering the new literacy practices that had to be studied, he could confidently make these claims within a context of theoretical and methodological sophistication that required a team of researchers and a visionary leader to enact.

### **Study 2: Exploring the Comprehension Strategies Used by Skilled Sixth Grade Readers When Reading on the Internet**

Situating the study within the context of new literacies theory (Lankshear & Knobel, 2003), the theory of cognitive flexibility (Spiro, Feltovich, Jacobson, & Coulson, 1991), and previous research in the areas of comprehension of print text, prior knowledge, inferential reasoning, self-regulation, and affective variables related to efficacy and motivation, Coiro and Dobler (2007) positioned their work both to incorporate what is known about readers' work with print texts and to generate questions around and energy behind the study of the differences between engaging with print text and texts found online. The work is distinguished by both its extensive positioning in the existing knowledge base and in its rigorous qualitative design and methods, conducted as "an in-depth analysis with few participants" given that the field knew little about these processes.

Warschauer's (2006) work included an investigation into the impact of laptop technologies on students' reading and writing skills in the classroom. Conversely, Coiro and Dobler's (2007) study reflects the majority of the state of the work in the field of English language arts in that it is young, seeking to illuminate ways readers approach texts and technologies before exploring any corresponding effects on achievement. The research in literacy education over the past 5 years has aimed to examine how readers and writers engage with online text and digital media both in and outside of the classroom (Coiro & Dobler, 2007; Leu et al., 2005).

Work has been general, seeking to understand readers' comprehension and meaning-making strategies when engaging with online texts. This study merits analysis, as it sets the stage not only for research investigating students' learning when deploying specific online reading strategies in the classroom, but also for methodological design utilizing verbal protocol analysis with readers who possess a range of print and online literacy skills.

The study is notably transparent, both in articulating the methods used in selecting the study population and in describing methods used for data collection and analysis. The researchers utilized purposeful selection to identify the eleven participants, offering ample discussion explaining the choice of skilled readers working in sixth-grade classrooms, as well as the procedures used to screen and filter those students whom teachers' recommended for participation. Although the study focused on a narrow, highly skilled group of student readers, researchers based that choice on the necessity of readers' comfort with verbal protocol analysis, thereby further strengthening the connections between study methodology, participant selection, and research methods deployed in the field.

Researchers met with students across three meetings: one for a tape-recorded think-aloud of each participant's completion of a task requiring reading a Web site in context, a second for a tape-recorded think-aloud of the participants' completion of a task requiring reading within a search engine, and a third meeting for member checking and a metadiscussion of strategy use across the group as a whole. Again, transparency is significant here, both in the description of what occurred at each of these meetings and in establishing a data corpus consisting of questionnaires, think-aloud protocols, field observations, and semistructured interviews.

Data analysis ran through four phases as the two researchers used a grounded-theory model (Glaser & Straus, 1967). Instead of relying solely on iterative readings of the data, the researchers first utilized Stake's (1995) direct-interpretation approach to identify a unit of analysis (here, a reading decision paired with an explanation; p. 38). During the second phase of analysis, researchers "applied constant comparative analysis across cases to scan a second transcript for propositional patterns that compared or contrasted with the first transcript" (p. 228). In the third phase, researchers coded transcripts for instances of prior knowledge. A fourth and final phase focused on analysis of "four self-regulatory comprehension strategies including mental planning, predicting, monitoring, and evaluating" (p. 228). Each phase is described at length to establish validity and consistency of coding and to address how outliers and inconsistencies were addressed.

The complex methods used by the researchers yielded findings that synthesize new findings about reading online text with known strategies

used by successful readers when engaging with print text. For example, in looking at the role of prior knowledge in a reader's work with an online text, two findings echoed and further supported what was known from work with print text (knowledge of the topic and knowledge of printed informational text structures), and two were unique to online text (knowledge of informational Web site structures and knowledge of Web-based search engines). Throughout the study, the researchers drew on the extensive literature base to establish the unique complexities of online reading, ranging from "a cognitive self-regulated reading process intertwined with new physical reading actions unique to Web-based reading contexts" (Glaser & Straus, 1967, p. 240) and "a high incidence of forward inferential reasoning across multiple layers of Internet texts" (p. 240). Although findings may be tied to a unique, narrow population, the methodological transparency paired with the extensive literature base interwoven throughout the study allowed the researchers (a) to draw inferences about the implications of study findings to populations of struggling readers and (b) to generate additional questions that help guide the future study of online reading.

### **FUTURE RESEARCH DIRECTIONS**

Issues embedded in twenty-first century reading, writing, and classroom contexts continue to raise questions. Can the research agenda in English education catch up, let alone keep up, with the changes in literacy practice and a focus on student achievement? Before raising even more questions, this chapter provides a little more background about the field of English education to help contextualize a response. In Goodwyn, Adams, and Clarke's (1997) interview study on preservice and in-service English teachers' perceptions of technology, the majority of teachers responded that they still needed to rethink what learning to read and write means in a technological age. Over the last 3 years, leaders of the Conference on English Education have begun to think, write, and advocate more intentionally about literacy and technology in terms of beliefs statements and actions addressing theory, practice, and research (see Swenson et al., 2005, 2006). In English education, as with other content areas, additional research is needed to help educators better understand the knowledge, pedagogies, and learning outcomes associated with new and emerging technologies, especially which tools and applications will most benefit student learning in English language arts. As Swenson (2006) explained,

Newer technologies have the potential to inform the research questions language arts educators have historically asked: How can we make the study of

language and communication purposeful and engaging for our students? How can we help our students to grow as readers, writers, listeners, and speakers? How can we help our students understand the benefits of language diversity? How can we help a new generation of students use language to create a safer, more tolerant, more humane world? (p. 23)

In addition to technology's potential for informing the longstanding research questions in English education, they also generate new questions that will begin to shape the future of our field and our understanding of how students learn best.

Looking ahead, we suggest a few questions here, knowing that answering them will involve collaborations between researchers, teachers, and students unlike traditional models of experimental and quasi-experimental designs that are the "standard" for scientific research in the current political climate and educational landscape:

- What are the effects of digital writing and reading on student achievement in traditional composition and comprehension? How will digital composition and comprehension force a redefinition of traditional notions of literacy in order to affect student learning the most?
- How will notions of mode, media, and genre be addressed in the context of various emerging technologies (e.g., blogs, wikis, podcasts, vidcasts, social bookmarking, etc.)? To what extent are teachers and students using multigenre reading and writing strategies, including digital texts, and how effective are these strategies in terms of addressing rhetorical issues of audience, purpose, and acceptance? How will these new technologies and literacies affect students' reading and writing abilities?
- To what extent are our students' outside-the-classroom literacy practices and media exposure/experiences affecting their literacy development and affecting their inside-the-classroom learning? To what extent are outside-the-classroom literacy practices affecting students' literacy learning?
- To what extent does technology provide opportunities for reaching, engaging, and effectively teaching resistant and at-risk readers and writers? To what extent is technology an effective tool for enhancing literacy learning for these students?
- What is the potential for video games and simulations to enhance students' literacy development, practice, and ability? What are the ethical, practical, and pedagogical consequences of using video games and simulations for academic purposes?

- How will English educators at all levels balance the need for schools to filter some online information and services effectively while still inviting students to do authentic research and engage in reading, writing, listening, speaking, viewing, and visually representing themselves online?
- How are new and emerging technologies affecting students with regard to issues of security, identity, plagiarism, copyright, and intellectual property? When and how should these issues be addressed in an already crowded curriculum?
- How will emerging technologies fare in terms of assessment with the continued focus on standardized testing as the major evaluation tool at the state and national levels? In what ways should educators use, modify, or resist such services as Turnitin.com, computerized writing assessment like Criterion, and tests of basic reading comprehension such as Accelerated Reader?

In considering how technology will shape past, present, and future research initiatives focusing on student learning in English education, we reiterate the concern that technology's mere presence in schools will not ensure better outcomes for students. The key component for change is teachers, those who will be affected by the change "rather than the innovation itself" (Fulkerth, 1992, p. 1), by honing their ability to integrate effectively new and emerging technologies into the classroom. Technology must be integrated in the service of and informed by richer curricula, enhanced and critical pedagogies, more effective organizational support, better ties between schools and society, and increased efforts to empower disenfranchised learners (Trotter, 1998). For teachers to become change agents and affect student learning with respect to technology, however, they must be able to develop a critical perspective that informs their pedagogical approach (Young & Bush, 2004), as well as some measure of informed technological expertise (McGrail & Rozema, 2005).

Moreover, those outcomes will not be traceable to one particular technological intervention. Since literacies are multiple, and any random sample of  $N$  students will still yield  $N$  number of individual literacy histories, any research seeking experimental models and attempting to make causal claims as its *de facto* mode of operation must be cautiously approached. By acknowledging the complexity of newer and multiple literacies—as well as the technologies that enable them—researchers can continue to focus on student learning in the broadest sense without being narrowly confined to pre- and post-assessments that measure only discrete components of reading comprehension, the writing process, or other isolated literacy skills. Ultimately, the field needs research at all levels and will benefit from additional studies like Warshauer's (2006) that

includes a large pool of participants and multiple data sources, as well as smaller, discrete studies so sorely lacking in the field.

We understand well just how overwhelming the changing nature of literacy can seem. Challenges in teacher education and professional development, new paradigms and methods for research, institutional barriers in K-12 school settings, and the many new evolving questions about technology's effects on student learning could paralyze us, forcing us to stop running or, worse yet, backpedal. Yet, there are opportunities to sprint ahead, to continue transforming our culture through the many new literacy practices that emerging technologies enable and support. These opportunities give us hope that the race has just begun and that we still have much to contribute to the processes of defining, understanding, maintaining, and *transforming* our schools and society. More importantly, to ensure a successful race for all participants, English educators must create and enact a more intentional and sustained research agenda addressing new and emerging technologies and their effects on student literacy and learning.

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